G 1280 **(Pages : 3)** **Reg. No.................................**

Name.....................................

B.TECH. DEGREE EXAMINATION, MAY 2015

First and Second Semester

EN 010 101—ENGINEERING MATHEMATICS – I

(Common for all Branches)

(New Scheme—2010 admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours | Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Find the rank of $\begin{bmatrix} 1 & 6 & -18 \\ -4 & 0 & 5 \\ -3 & 6 & -13 \end{bmatrix}$ by reducing to Echelon form.

2. If $f(x,y) = y^2 e^{x+3}$, find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$.

3. Evaluate $\int_0^1 \int_0^2 xy^2 \, dy dx$.

4. Solve $\frac{dy}{dx} - y \cot x = 2x \sin x$.

5. Find Laplace transform of $t \cos 2t$.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Find Eigenvalues and Eigenvectors of :

$$\begin{bmatrix} 3 & -6 & -6 \\ -1 & 0 & 2 \\ 3 & 0 & -4 \end{bmatrix}.$$

Turn over

7. If $u = \dfrac{y^2}{2x}, V = \dfrac{x^2 + y^2}{2x}$ find $\dfrac{\partial(u,v)}{\partial(x,y)}$.

8. Evaluate $\int_0^{\pi/2} \int_0^{a\cos\theta} r^4 dr\, d\theta$.

9. Solve $\left(D^2 - 5D + 6\right) y = 0$.

10. Find $L\left(\dfrac{e^{at} - e^{bt}}{t}\right)$.

(5 × 5 = 25 marks)

Part C

*Answer **all** questions.*

Each question carries 12 marks.

11. (a) Reduce the quadratic form $8x_1^2 + 7x_2^2 + 3x_3^2 - 12x_1x_2 - 8x_2x_3 + 4x_3x_4$ to sum of squares. (8 marks)

(b) Obtain the quadratic form associated with the matrix $\begin{bmatrix} 5 & -3 & 1 \\ -3 & -4 & 2 \\ 1 & 2 & 7 \end{bmatrix}$. (4 marks)

Or

12. (a) Diagonalise the matrix $\begin{bmatrix} 3 & -2 & 4 \\ -2 & -2 & 6 \\ 4 & 6 & -1 \end{bmatrix}$. (8 marks)

(b) Solve $3x + y = 5z = 0, 5x - 3y - 6z = 0$ and $x + y - 2z = 0$. (4 marks)

13. (a) Using Taylor's theorem express the polynomial $2x^3 + 7x^2 + x - 6$ in power of $(x-1)$. (7 marks)

(b) Show that the function :

$f(x,y) = x^3 + y^3 - 6z(x+y) + 12xy$ has a maximum at (–7, 7) and a minimum f (3, 3). (5 marks)

14. (a) If $z = f(x, y)$ and $x = r\cos\theta, y = r\sin\theta$ then prove that $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right) + \frac{1}{r^2}\left(\frac{\partial z}{\partial \alpha}\right)^2$.

(5 marks)

(b) Find a point on the sphere $x^2 + y^2 + z^2 = 1$. Which is at a maximum distance from the point (1, 2, 3).

(7 marks)

15. (a) Change the order of integration and evaluate $\int_0^3 \int_1^{\sqrt{4-y}} (x+y)\, dx\, dy$. (7 marks)

(b) Evaluate $\iiint_D \frac{dx\, dy\, dz}{(x+y+z+1)^3}$, where D is the region bounded by the planes $x = 0, y = 0, z = 0$ and $x + y + z = 1$.

(5 marks)

Or

16. (a) Evaluate $\iint_D \sqrt{x+y}\, dx\, dy$ when D is the parallelogram bounded by the lines $x + y = 0$, $x + y = 1, 2x - 3y = 0, 2x - 3y = 4$.

(8 marks)

(b) By transforming into polar co-ordinates evaluate $\int_0^a \int_0^a \frac{x\, dy\, dx}{x^2 + y^2}$. (4 marks)

17. (a) Solve $x^2y'' - 3xy' - 5y = \sin(\log x)$. (7 marks)

(b) Solve $(D^2 - 4D + 3)\, y = e^x \cos 2x$. (5 marks)

Or

18. (a) By method of variation of parameter solve $y'' + 3y' + 2y = x^2$. (7 marks)

(b) Solve $(D^2 - 4D + 4)\, y = 3\, x^2 e^{2x} \sin 2x$. (5 marks)

19. (a) Solve $y'' + 4y' + 3y = e^{-t}, y(0) = 0, y'(0) = 1$. (7 marks)

(b) Find $L^{-1}\left(\frac{e^{2s} - e^{-3s}}{s^2 + 4s + 5}\right)$. (5 marks)

Or

20. (a) Find Laplace transform of $f(t) = \begin{cases} -t, 0 < t < \pi \\ t, \pi < t < 2\pi \end{cases}$. (7 marks)

(b) Find $L^{-1}\left(\frac{3s - 2}{s^2 + 3s^2 + 2s}\right)$. (5 marks)

[5 × 12 = 60 marks]